



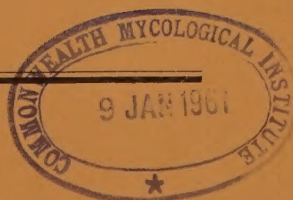
TANGANYIKA

**MINISTRY OF AGRICULTURE AND CO-OPERATIVE
DEVELOPMENT**

Annual Report
of the
Department of Agriculture
1959

PART II
(Research)

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PART II
(*Research*)

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TANGANYIKA

ANNUAL REPORT OF THE DEPARTMENT OF AGRICULTURE, 1959

PART II

INTRODUCTION

Staff changes have been few. Mr. D. G. Jones and Mr. H. J. Van Rensburg were appointed Senior Research Officers (A) and took charge of Western and Northern Regional Research Centres respectively. Mr. E. C. Diekmahns was appointed Senior Research Officer (B) in charge of the Sisal Research Station.

Mr. D. A. Burdekin was appointed to one of the vacant plant pathologist posts. Mr. P. J. Northwood and Mr. D. F. Osbourn, Agricultural Officers, were posted to carry out research on cashew and pyrethrum at the Southern Regional Research Centre and Njombe. Mr. J. N. Auckland and Mr. J. C. Macartney were posted to the Western and Northern Regional Research Centres to carry out the duties of Agricultural Officers (Experiments).

During the year Mr. J. E. Peat, C.B.E., Chief Scientific Officer, Empire Cotton Growing Corporation, retired. The scientific work carried out by Mr. Peat during his long service at Ukiriguru on cotton breeding and soil fertility has been most valuable and contributed greatly to the increase in cotton production in Lake Province. Mr. G. W. Lock, O.B.E., Senior Research Officer (B) retired. Mr. Lock had been in charge of the Sisal Research Station since its beginning and the sound basis on which the scientific work that has been done on sisal rests is largely due to his careful and thorough work. Dr. E. A. Riley, Plant Pathologist, Dr. M. J. Cole, Botanist and Mr. T. F. O'Callaghan, Agricultural Officer, resigned from the service.

Mr. G. A. Semiti (Experimental Officer) was awarded an Overseas Bursary and is now receiving advanced training at the Plant Breeding Institute, Cambridge, England.

Studies on methods of maintenance and improvement of soil fertility are continuing to yield valuable results, particularly at Maruku and Mwanhala. A soil survey of an area growing cocoa in Tanga Province has been carried out and soil samples are being analysed so that suitable areas for production can be defined. The Agricultural Chemist, Nachingwea, continued his soil survey work in the Rufiji Basin Survey project. Soil fertility work and plant analysis at the Coffee Research Station, Lyamungu, has been started again with the secondment of a chemist from the Government Chemist Department.

Work on breeding improved varieties of castor-bean has given disappointing results since it has not proved possible to achieve a reasonable level of control of the many sucking insects damaging flowers and young seed capsules. A programme for the improvement of food legumes was started at the Central Regional Research Centre. A large collection of species was grown and it appeared that in a number of cases selection might well bring about an improvement in yield. The officer-in-charge of this programme has gone to England for advanced training and it will be held in abeyance.

At the Western Regional Research Centre the cotton breeding material formerly kept in three separate programmes was amalgamated and will be used to produce commercial varieties, highly resistant to bacterial blight, with other field characteristics up to the standard of the most recent seed issues and satisfying the quality requirements of the industry. An additional plant breeder has been posted to the Central Regional Research Centre to work on the production of strains suitable for irrigation and to increase blight resistance in Eastern Province cotton.

The breeding programme on soya beans at the Southern Regional Research Centre has now reached a stage where a large number of potentially valuable strains require to be tested rigorously to choose a few for field testing. It is clear now that considerable improvements have been achieved in yield and plant habit.

In a number of areas in the Territory termites do much damage to crops at harvest time and also to growing crops. The application of Aldrin in fertilizer or as a seed dressing appears to be a promising method of control. Work on the American bollworm, a serious pest of cotton, has been held up in Lake Province since the incidence of the pest has been very low during the past two seasons.

At the Northern Regional Research Centre a seed-testing laboratory has been set up in connection with the seed-bean industry to ensure that the standards required by importing countries are met as regards freedom from disease.

Fusarium wilt of cotton was found in Geita District in 1954. Whilst past surveys have not been sufficiently extensive to prove that the disease is spreading it appears likely that this is the case.

More detailed information regarding items in this report will be made available on application to the officers in charge of research stations.

STAFF—RESEARCH DIVISION

(As at 31st December, 1958)

HEADQUARTERS

Chief Research Officer: A. C. Evans, B.Sc. (Bristol), D.I.C., Ph.D. (London).

Botanist: D. J. Turner, B.Sc. (Agric.) (Reading), Ph.D. (Edinburgh).

Assistant Agricultural Officer: A. Sreedharan, B.Sc. (Travancore).

Research Assistant: Mrs. I. C. Walker.

CENTRAL REGION

Research Centre, Ilonga (P.O. Box 6, Kilosa):

Pasture Research Officer i/c: T. O. Robson, B.Sc. (Witwatersrand).

Agricultural Officer (Experiments): A. M. MacDonald, B.Sc. (Agric.) (Aberdeen), D.T.A. (Trinidad).

Farm Manager: J. R. Tile.

The following officers are seconded from the Empire Cotton Growing Corporation.

Plant-Breeder: R. Smith, B.Sc. (Manchester).

Plant-Breeder: J. E. Cross, B.Sc. (Wales), M.S. (Minnesota).

Entomologist: E. W. Valentine, B.Agric.Sc. (New Zealand).

(a) *Coast Experimental Station:*

Field Officer (Agriculture): B. Minto, C.D.A.

(b) *Mbozi Sub-Station (P.O. Mbozi):*

Senior Field Officer (Agriculture): J. I. Thompson.

Agricultural Officer for Territorial Pyrethrum Research: D. F. Osbourn, B.Sc. (Agric.) (Reading), stationed at Njombe.

NORTHERN REGION

Research Centre, Tengeru (P.O. Box 3020, Arusha):

Senior Research Officer: H. J. Van Rensburg, M.Sc. (Witwatersrand).
Entomologist: G. Swaine, B.Sc. (Sheffield).
Plant-Breeder: B. G. Houston, B.Sc. (Agric.) (Aberdeen), Dip.Agric. Sc. (Cambridge), D.T.A. (Trinidad).
Plant-Pathologist: P. K. S. Clinton, B.Sc. (Sheffield).
Plant-Pathologist: D. A. Burdekin, B.A. (Cambridge).
Agricultural Chemist: G. D. Anderson, M.Sc. (Agric.), Ph.D. (Durham).
Experimental Officer (Plant Pathology): B. Simon, B.Sc. (Makerere).
Farm Manager: G. L. Goodhew.

(a) *Ikowa Sub-Station:*

Field Officer (Agriculture): T. J. Aldington, N.D.A., N.D.Agric.E.

SOUTHERN REGION

Research Centre, Nachingwea (P.O. Box 43, Nachingwea):

Agricultural Officer (Ag. Senior Research Officer): F. M. Spencer, B.Sc. (Hort.) (Reading).
Entomologist: M. Bigger, B.A. (Trinity College, Dublin), D.T.A. (Trinidad).
Plant-Breeder: A. K. Auckland, B.Sc. (Durham), Dip.Agric.Sc. (Cambridge). D.T.A. (Trinidad).
Agricultural Chemist: B. Anderson, M.Sc. (Agric.) (Reading).
Agricultural Officer: P. J. Northwood, B.Sc. (Agric.) (Reading).
Farm Manager: M. J. Simmonds.

(a) *Mtopwa Sub-Station:*

Assistant Agricultural Officer: K. J. Rwiza, Dip.Agric. (Makerere).

(b) *Saluti Sub-Station:*

Field Officer (Agriculture): M. T. Long, N.D.A., C.D.A.

WESTERN REGION

Research Centre, Ukiriguru (Private Bag, Fela):

Senior Research Officer: D. G. Jones, B.A., Dip.Agric.Sc. (Cambridge), A.I.C.T.A.
Pasture Research Officer: G. D. Scott, B.Sc. (Witwatersrand).
Entomologist: I. A. D. Robertson, B.Sc. (Aberdeen).
Agricultural Officer (Experiment): J. N. Auckland, B.Sc. (Agric.) (Reading).
Farm Manager: D. F. L. Rose, N.D.A., C.D.A.
Assistant Farm Manager: T. Apyio, Dip.Agric. (E.A.).

The following officers are seconded from the Empire Cotton Growing Corporation:

Chief Scientific Officer: G. M. Wickens, B.Sc. (Agric.) (Reading), D.I.C., Ph.D. (London).
Plant-Breeder: M. H. Arnold, M.A. (Cambridge).
Plant-Breeder: K. J. Brown, B.Sc. (Reading).
Plant Pathologist (Temporary part-time): Kathleen M. Arnold, M.A., Ph.D. (Cambridge).
Experimental Officer (Chemist): A. M. Kabaara, B.Sc. (Makerere), on study leave in United Kingdom.

(a) *Experimental Station, Mwanhala:*

Agricultural Officer: D. B. Scott, B.Sc. (Agric.) (Dunelm), D.T.A. (Trinidad).

(b) *Experimental Station, Urambo:*

Field Officer: T. Muir.

COMMODITY STATIONS

(Staff Secondment)

1. *Sisal Research Station, Mlingano (P.O. Ngomeni):*

Financed by Tanganyika Sisal Growers Association

Senior Research Officer: E. C. Diekmahns, B.Sc. (Glasgow), Dip.Agric.Sc. (Cambridge).
Agricultural Officer: C. M. H. Atkins, B.Sc. (Agric.), London.
Farm Manager: R. J. Bumpstead.

2. *Coffee Research Station, Lyamungu (P.O. Moshi):*

Financed by Tanganyika Coffee Board

Senior Research Officer: F. R. Sanders, B.A., Dip.Agric. (Cambridge).

Entomologist: R. G. Tapley, B.Sc. (London).

Chemist: J. C. Warden, B.A. (Oxford), Seconded from Government Chemist.

Agricultural Officer: A. J. M. Gunn, B.Sc. (Aberdeen).

Horticulturist: L. M. Fernie.

Farm Manager: S. D. Pyman.

(a) *Experimental Station (Coffee) Maruku (P.O. Box 127, Bukoba):*

Agricultural Officer: H. W. Mitchell, B.Sc. (Agric.), London, D.T.A. (Trinidad).

Farm Manager: N. Hutton-Jamieson, C.D.A.

3. *Tobacco Research Station, Iringa (P.O. Box 182, Iringa):*

Financed by Southern Highlands Non-Native Tobacco Board

Agricultural Officer: B. C. Akehurst, M.B.E., B.Sc. (Agric.) (Reading).

Agricultural Officer: B. Walker, B.Sc. (Agric.) (Nottingham), Dip.Agric. (Reading), D.T.A. (Trinidad).

4. *Pasture Research Station, Kongwa (P.O. Kongwa):*

Financed by Tanganyika Agricultural Corporation

Pasture Research Officer: M.A. Owen, B.Sc. (Agric.) (Wales), Dip.Agric. (Reading), D.T.A. (Trinidad).

SOIL FERTILITY

At the Southern Regional Research Centre, Nachingwea, the general soil fertility programme was continued. In the heavy lime experiment, (NACH. 2), groundnuts yielded well, 1,100–1,200 lb. per acre, but only miserably low yields of maize were obtained, 15–190 lb. per acre. Thus the results were similar to those obtained in 1958. Preliminary leaf analyses have not given any reason for this differential effect. A series of crops was grown in observation strips adjacent to the experiment. The result was clear cut: non-leguminous crops, maize, sorghum and sesame made poor growth but legumes, groundnuts, soya, pigeon-pea and cow-peas grew well or reasonably well and so can be recommended for planting on such local patches of soil.

Yields were low in the comparison of farming systems trial (NACH. 6, 7, 8), except for groundnuts. Sorghum and maize were badly infested by *Striga* and sesame was wiped out by wireworms. Early cessation of the rains also affected the later sown crops. A summary of the results to date is presented in Table 1.

TABLE 1
EFFECT OF FARMYARD MANURE AND FERTILIZERS ON A RANGE OF CROPS. MEANS FOR TWO YEARS OF CONTROL PLOTS AND RESPONSE TO TREATMENTS. LB. PER ACRE

Crop	Control	Response to		Control	Response to	
		PN1	PN2		3 tons FYM	6 tons FYM
Maize ...	569 ...	128 ...	344 ...	1,001 ...	93 ...	282
Sorghum ...	207 ...	233 ...	233 ...	412 ...	450 ...	735
Groundnuts ...	1,006 ...	166 ...	206 ...	1,037 ...	39 ...	42
Soya ...	422 ...	49 ...	103 ...	718 ...	180 ...	276
Pigeon-pea ...	94 ...	36 ...	25 ...	100 ...	18 ...	65
Cow-pea ...	143 ...	— ...	— ...	84 ...	106 ...	84

P=100 lb. single superphosphate per acre.

N1=100 lb. sulphate of ammonia per acre.

N2=200 lb. sulphate of ammonia per acre.

Responses to fertilizers are rather disappointing except in the case of groundnuts. Soya and sorghum have responded well to farmyard manure.

In a fertility experiment (NACH. 3) comparing farmyard manure, the ash of an equivalent amount of farmyard manure and fertilizers much higher responses were obtained.

TABLE 2
RESPONSE OF MAIZE (AVERAGED OVER 1958 AND 1959) AND
OF SOYA BEAN (1959) TO MANURIAL AND FERTILIZER
TREATMENTS. LB. PER ACRE

	Maize	Soya Bean
Control	931	604
Responses to:—		
Farmyard manure	777	426
Ash of farmyard manure	705	390
Fertilizer	327	89
Fertilizer and farmyard manure	560	506
Fertilizer and Ash of farmyard manure	671	580

For each crop, the response is least for an application of fertilizers, but there are no significant differences between the responses shown by farmyard manure and its ash alone or in the presence of fertilizers.

On the Nagaga sand soil type (NACH. 1) groundnuts responded to superphosphate, 173 lb. per acre, but not to sulphate of ammonia or potash.

Yields of soya beans were not affected by the application of sulphate of ammonia at planting and at 30 or 60 days after planting. Single superphosphate at 100 lb. per acre, gave an increase in yield of 112 lb. (NACH. 13). Neither phosphate nor sulphate of ammonia increased sesame yield (NACH. 9).

At the Central Regional Research Centre, Ilonga, a first test crop of maize was taken on a fallow experiment (IL. 1) comparing one-, two- and three-year fallows of various types with continuous cultivation.

TABLE 3
MAIZE YIELDS AFTER VARIOUS TYPES OF FALLOW AND CONTINUOUS
CULTIVATION. LB. PER ACRE

	Years of Fallowing		
	1	2	3
Bastard Fallow	1,695	1,919	1,799
Planted Tridax	1,625	2,311	2,477
Elephant Grass	1,746	760	1,201
Pigeon-Pea	2,101	1,899	2,138

Continuous cultivation 2,450.

None of the fallow treatments gave an appreciable increase in yield over continuous cultivation in the first test year.

In the experiment comparing rotation with continuous cultivation of three crops (IL. 2) the results, in the fourth year, do not suggest any adverse effect of continuous cultivation.

TABLE 4
YIELDS OF THREE CROPS IN ROTATION AND CULTIVATED
CONTINUOUSLY. LB. PER ACRE

	Rotated	Continuous
Cotton	578	641
Maize	1,689	1,570
Sorghum	66	78

Sorghum yields were low due to bird damage and smut infection.

Previous work at Ilonga did not give any indications that fertilizers would increase yields. Following up an observation that sulphate of ammonia gave a large but not significant increase in yield of seed cotton on land that had been under peasant cultivation for many years, an experiment to test the value of farmyard manure, phosphate and sulphate of ammonia was planted on the same type of land. Phosphate, 75 lb. per acre, gave a significant mean increase in yield of 280 lb. of seed cotton per acre. Five tons of farmyard gave an increase of 156 and two cwt. of sulphate of ammonia only 90 lb.

At Mwanhala, Nzega District, rainfall was low from December to March and very low in April. A total of 16.8 in. fell in this period. In spite of this, good yields were generally obtained from early planted crops when fertilizer or manure was applied. (Tables 5-9).

TABLE 5

EFFECT OF DATE OF PLANTING ON RESPONSE TO FERTILIZER.				LB. PER ACRE	
Crop	Date	Unfertilized	Fertilized	Response	
Maize ... (MWA6)	22/12	473	1,350	...	877
	8/1	190	1,084	...	894
	26/1	195	335	...	140
Sorghum ... (MWA8)	22/12	1,625	2,321	...	696
	7/1	1,018	1,278	...	260
	20/1	201	436	...	235
Groundnuts ... (MWA5)	19/12	950	1,359	...	409
	7/1	341	392	...	51
	20/1	164	284	...	120
Soya ... (MWA7)	19/12	288	661	...	373
	7/1	235	444	...	209
	17/1	123	129	...	6

For sorghum, groundnuts and soya, fertilizer gave a good economic response at the December planting only. For maize, a good economic response was obtained at the December and early January plantings (MWA. 5, 6, 7, 8).

In one fertility experiment (MWA. 2) the continuous application of manure or fertilizer gave good increases in yields for maize, 824 and 1,166 lb. per acre, for 3 and 6 tons of manure, and 868 lb. for fertilizer on a control yield of only 369 lb. Mean responses over the two years, one of fair rainfall and one of very low rainfall, are given below.

TABLE 6
CONTROL YIELD AND RESPONSES TO MANURE AND FERTILIZER TREATMENT
MEAN OF TWO YEARS. LB. PER ACRE

Treatments	1958	1959	Maize	Groundnuts
Control Yield	0	0	530	302
Responses:—				
Manure	3	0	Nil	Nil
	3	3	587	Nil
	6	0	229	Nil
Fertilizer*	6	6	539	Nil
	Applied	Applied	952	171

*120 lb. double superphosphate with 120 lb. of sulphate of ammonia in addition for maize.

Fertilizer applications have given greater responses than manure. Responses by groundnuts to manure were not significant.

In another fertility experiment (MWA. 3), similar results were obtained for maize and groundnuts in pure stands.

TABLE 7
CONTROL YIELDS AND RESPONSES TO MANURE AND FERTILIZER, ALONE AND TOGETHER, MEANS OF TWO YEARS. LB. PER ACRE

Crop			Yield of Control			Responses to Fertilizer		Manure			Both
<i>Pure Stands:</i>											
Groundnuts	...	...	299	...	157	...	72	...	167		
Maize	...	...	928	...	748	...	445	...	945		
Castor	...	...	206	...	135	...	162	...	243		
<i>Intercrop:</i>											
Groundnuts	...	...	215	...	Nil	...	Nil	...	Nil		
Maize	...	...	380	...	452	...	267	...	667		

Good economic responses for maize in pure stand were shown for fertilizer and manure, but for groundnuts the response to fertilizer was good but low to manure. Castor gave fair responses to both fertilizer and manure. For maize and groundnuts inter-cropped, responses were suppressed for groundnuts and reduced for maize on a straight comparison.

Good responses to fertilizer and manure were obtained in an experiment (MWA. 4), started this year to compare the effect of these treatments on cash crops.

TABLE 8

CONTROL YIELDS AND RESPONSES TO FERTILIZER AND MANURE, ALONE AND IN COMBINATION, TO SEVERAL CASH CROPS. LB. PER ACRE

	Yield of Control	Responses to			
		Fertilizer	Manure	Both	
Groundnuts (2 var.)					
Mwitunde	336	300	392	333	
Mamboleo	261	582	226	847	
Castor	150	90	40	180	
Sesame	157	139	204	263	
Soya	77	171	96	196	

Superphosphate and manure applied in 1957 continued to give increased yields for groundnuts (MWA. 1).

TABLE 9

YIELDS FOR SECOND-YEAR RESIDUAL EFFECTS OF MANURE AND SUPERPHOSPHATE TOGETHER WITH AN ASSESSMENT OF PROFIT TO DATE

	Lb. per acre	Profit Shs. per acre
Control	315	—
3 tons manure	363	86
100 lb. superphosphate	417	147
200 lb. superphosphate	436	237

At Maruku, the first yields have been obtained from the Robusta Coffee Establishment Experiment (MAR. 5), planted in 1956.

TABLE 10

EFFECT OF FARMYARD MANURE AND FERTILIZERS ON THE YIELD OF CLEAN COFFEE, LB. PER ACRE (MEAN OF WITH AND WITHOUT LIME TREATMENTS)

Farmyard Manure in planting hole	Nil	Fertilizer Treatments		Means
		In planting hole	In planting hole and annually	
Nil	12	8	54	28
20 lb.	24	54	143	74
40 lb.	129	129	224	161
Means	55	64	140	

Lime had no effect on yield. The yield from the trees without fertilizer or manure is miserably low. Both manure and annual top dressings of fertilizers (2 cwt. sulphate of ammonia, 2 cwt. double superphosphate and 1 cwt. of muriate of potash) have given useful yields. In the Establishment Experiment at Kituntu (MAR. 22), manure in the planting hole has improved the growth rate of both *arabica* and *robusta* seedlings in the first year. At Kaibanja on a black cotton soil no improvement has been noted. (MAR. 19).

In the "Rweya Land" manurial experiment (MAR. 9), useful responses in the third year after application of the manure were given by pigeon-peas. Farmyard manure gave a mean response of 400 lb. per acre. The experiment was replanted with maize and beans but these are making poor growth and it would appear that the residual value of the treatment is exhausted.

In the grassland fertility experiment (MAR. 7), the heaviest yield of dry matter was obtained from two cuts per annum and the lowest from six cuts.

TABLE 11

DRY GRASS PRODUCTION—LB. PER ACRE				
No. of cuts	1957	1958	1959	
6	6,589	5,470	4,295	
4	7,117	7,025	5,677	
2	9,706	10,215	10,661	

There is a strong suggestion that production is declining under the two more intensive cutting regimes but is being maintained at the lightest level. Responses to phosphate and potash in the third year after application were negligible. Phosphate again did not increase production and potash only produced a small response. In the first two years, sulphate of ammonia gave large increases in yield but this year the response was considerably reduced: at an application of 1 cwt. per acre the response was 1,400 lb. of dry grass as against 3,700 lb. previously. Lime showed a small response of 1,200 lb. per acre.

The results of the past three years' work have shown that the productivity of the poor "Rweya" land can be considerably increased by the application of fertilizers and farmyard manure. Work has now begun to determine the amounts of the various fertilizers required to produce the most economic return.

At the Regional Research Centre, Ukiriguru, yields of seed cotton were generally lower than last year owing to long dry spells from early March onwards. Responses to manures and fertilizers were also lower even though in some instances the control yields were similar.

TABLE 12
YIELD OF SEED COTTON, LB. PER ACRE
UK. 9—Twelfth year of Experiment

Treatment	Yield	Response
A.—Nil	939	...
B.—75 lb. basic slag applied 1950/51, reapplied 1956/57, and 90 lb. urea applied 1959	1,078	... 139
C.—6 tons FYM applied 1950/51 and 1956/57	1,231	... 291
B + C	1,324	... 385
UK. 26—Eighth year of Experiment		
A.—Nil	534	...
B.—150 lb. double superphosphate applied 1951/52 and 1954/55 and 50 lb. sulphate of ammonia applied 1959	736	... 202
C.—6 tons FYM applied 1951/52 and 1954/55	837	... 303
B + C	860	... 326
UK. 44—Second year of Experiment		
A.—Nil	858	...
B.—100 lb. double superphosphate applied 1957/58 and 200 lb. sulphate of ammonia 1959	1,180	... 322
B. plus 280 lb. gypsum applied 1957/58	1,062	... 204

Yield figures, showing the responses obtained in three experiments from simple treatments, are given in Table 12, as illustrative of their value particularly of farmyard manure applied 3 and 5 years previously. Again this year the positive NP interaction characteristic of the application of sulphate of ammonia and superphosphate has not been shown. The application of gypsum in 1958 has not given any increase in yield even in the presence of superphosphate and sulphate of ammonia.

An experiment testing the value of fertilizers and farmyard manure applied continuously for 5 years has been carried out at Tengeru Northern Regional Research Centre, on a volcanic soil giving a high control yield.

TABLE 13
RESPONSE BY MAIZE TO FERTILIZERS AND MANURES, LB. PER ACRE (TEN, 5)

	1955	1956	1958	1959	Mean
Control	3,682	4,859	2,546	3,125	3,553
Responses to:					
80 lb. superphosphate	—372	180	—101	—213	—127
250 lb. sulphate of ammonia	354	—162	1,029	400	405
Both above	75	80	1,068	1,175	599
5 tons farmyard manure	187	20	760	1,700	667

During the first two years the mean responses were not significant. In 1957, there was a heavy attack by stem-borer and yields were not measured. In 1958 and 1959, sulphate of ammonia, alone and in the presence of superphosphate, gave good responses as did farmyard manure. Superphosphate clearly is not required.

The effect of burning, burying or removing maize stubble on yield was also studied over a five-year period. Yields were unaffected by the different treatments on this fertile soil. (TEN. 7).

DATE OF PLANTING

Four experiments (ILO. 3) have now been carried out at Ilonga 1956-1959 to study the influence of planting on the flat, on the ridge and on tied ridges on the characteristic drop in yield at late planting. It was thought that ridging and tie-ridging might improve yields at later plantings due to better conservation of the lower amount of rainfall.

TABLE 14
YIELDS OF TWO CROPS ON TIED RIDGES AT THREE TIMES OF PLANTING,
EXPRESSED AS PERCENTAGE OF YIELD ON FLAT CULTIVATION

				Time of Planting		
				January	February	March
Groundnuts	...	...	...	89	116	102
Maize	...	...	...	112	93	97

Each crop was grown twice and the figures given in Table 14 are based on mean yields. There is no definite sign of general increase in yield of crops grown on tied-ridges compared with those grown on the flat.

At Ukiriguru the application of sulphate of ammonia to a short season variety of cotton planted late did not increase its yield to the level of the present commercial varieties planted early.

IRRIGATION

With increasing experience, some of the local difficulties and hazards of irrigation are becoming clearer. The three most important are:—

- wetting the ridge adequately to ensure good, even germination on some soil types;
- the depredations of pests and game on small schemes in dry areas;
- generally low yields even with fertilizer application.

At the Ikowa Irrigation Scheme, Dodoma District, the staff and labour are becoming more experienced and most of the programme was completed successfully. Game, birds and pests caused serious damage to a number of crops chiefly cotton, castor, sorghum and legumes.

On the grey and brown soils there is lateral penetration of irrigation water into the ridge. On the red soils water tends to penetrate straight into the ground thus giving rise to poor and uneven germination of seeds planted on the ridge. In a trial (IKO. 31) to determine the best way of planting on the ridge on the red soil, it was found that planting on the side of the ridge gave a much higher percentage emergence than planting on the top, but that there were no advantages to be gained from dry planting or using pre-soaked seed.

Yields of several varieties of maize were better on the red and brown soils than on the grey soil. The average yield was just over 1 ton per acre and the best individual yield was 4,060 lb. per acre. Unirrigated maize yielded an average of 640 lb. per acre. The rice varieties Afaa Kilombero 1/166 and 1/355 and Introduction 1/355 yielded well 4,370 and 3,770 lb. paddy per acre. Sorghum yields were low, 75-1,430 lb. per acre for Rhodesian Red, the yields being a reflection of the severity of attack by bollworm, aphids, *Calidea* and midge.

In the dry season, Canadian wonder beans and chick-pea yielded well. Approximately 2½ tons per acre of green beans and 670 lb. of seed beans were produced. Chick-pea yielded from 600-1,080 lb. per acre. On the red soil cow-pea gave a yield of 1,030 lb. per acre.

Yields of irrigated groundnuts were low, averaging 480 lb. per acre. Soya bean gave an average yield of 860 lb. per acre and so would appear to be a useful crop if the new types being produced at Nachingwea prove suitable. Giant castor gave an average yield of 590 lb. per acre on the ox-cultivated plots. Sprayed cotton produced yields of over 1,000 lb. per acre but the percentage Grade A ranged from 15-28, thus giving a poor cash return.

The pest position is so bad that it has been decided not to grow cotton again. The Morada variety of simsim gave 730 lb. per acre on the brown soil and may prove useful. Solouk Turkish tobacco produced a big heavy leaf and so was grown on for seed producing 660 lb. per acre.

The land on which the fertility experiment is planted is very variable but there is an indication that groundnuts and soya beans are benefiting from the application of fertilizer or farmyard manure.

At Mang'onyi, Singida District, trials were continued with a range of crops to find suitable additional crops to maize which is the main crop grown by the cultivators and with the study of soil fertility. Game, vermin and pests were troublesome here also.

Arabica coffee is not doing well, nearly half the plants producing no crop at all and only a very few (2 per cent) a full crop. The remainder produced a light crop. Green scale and very late pruning in addition to the prevailing high drying wind were responsible for the poor production. A drought-resistant type and Robusta are now being planted within banana "boxes". Of the range of citrus fruits planted only oranges and grapefruit are doing well. Cashew is a failure on the dry land, and poor under irrigation.

West Nile sunflower yielded 710 lb. per acre as against 510 lb. for the local very mixed type. At very low plant populations an early variety of soya bean yielded 380 lb. per acre. Groundnuts yielded poorly. Canadian wonder beans produced 330 lb. per acre and white haricot only 20 lb.

The results of the fertility trial suggest that low soil fertility may well be an important factor in limiting yields. Maize gave excellent responses to 5 tons of farmyard manure or 2 cwt. of sulphate of ammonia and 2 cwt. of triple superphosphate per acre.

TABLE 15
YIELDS OF TWO MAIZE VARIETIES, LB. PER ACRE

				Nil		Farmyard Manure		Fertilizer
Early Pearl	...	...	...	920	...	1,560	...	1,895
Katumbili	...	...	...	1,145	...	2,030	...	2,430

Katumbili plants produced a higher proportion of plants bearing cobs than Early Pearl. Even on the high yielding plots only 56 per cent of the plants produced cobs. It has been noticed at Ikowa that a high proportion of otherwise good plants did not produce cobs.

At the Beta Irrigation Trial Farm of the Rufiji Basin Survey, Rufiji District, a series of crops were grown to gain an assessment of yields under differing water regimes and planting dates.

Different intensities and times of application of water did not lead to any appreciable increases in yield for cotton planted early in the rainy season. Although damage by stainers was considerable, yields were of the order of 1,000 lb. cotton per acre. Soya beans were planted in the wet and dry seasons, the best yield was only 700 lb. per acre. Groundnut yields were also poor due to an unidentified wilt. Elephants and wild pigs pulled or dug up a high proportion of the plants before harvest. An early planting of Hungarian dwarf castor bean gave a good yield, 1,362 lb. per acre. Later plantings gave low yields.

A wide range of rice varieties was grown, the best yield was just under 2,000 lb. per acre. Sesame yields were very poor from both wet and dry season plantings.

The only crop to produce good yields was Hibiscus, plantings in January and February producing yields of 984-1,365 lb. of fibre per acre. Retting was accomplished in 11-14 days and fibre length was good, 10-14 feet. Yields of jute were low, 535-762 lb. per acre of fibre.

At Uru Chini, Moshi District, trials were carried out on a number of crops to determine their suitability for the area. Cotton, chillies, maize, onions, lucerne, groundnuts, soya beans and sesame were planted. Cotton grew well averaging 1,267 lb. of seed cotton per acre. The crop was sprayed. Chillies yielded well, 853 lb. of excellent quality dried fruit

and was sold for Shs. 25/- per frasila of 36 lb. or Shs. 590/- per acre. Promising yields of soya bean were obtained from some small plots of soya beans, 1,058-1,285 lb. per acre. Sesame and groundnuts were virtual failures, the former suffering severely from aphid and mildew and the heavy soil being unsuitable for the latter crop. Lucerne and hibiscus were not promising.

Four varieties of soya beans were grown under irrigation at Nachingwea during the dry season. Yields varying from 1,482-2,119 lb. per acre were obtained. It is possible that soya bean may prove to be a suitable crop for large scale production during the dry season on irrigation schemes.

In 1958 it was noticed at the T.A.C. Rujewa Trial Farm that cotton plants 7 feet tall had roots penetrating only about 9 inches into the ground and it was assumed that an unnecessarily large amount of water was being applied. Three trials were laid down to study a number of watering regimes. The yield on rainfall alone was good, 2,010 lb. seed cotton per acre, and irrigation did not produce a general increase in yield.

INTERCROPPING

An experiment MWA. 1B was begun in the 1958 season to determine the effect of intercropping early-sown groundnuts with late-planted cassava and castor. The cassava was dug after 14 months.

TABLE 16
THE EFFECT OF INTERCROPPING GROUNDNUTS WITH CASSAVA OR CASTOR
LB. PER ACRE (CASSAVA FRESH WEIGHT)

Treatment:	Groundnuts			Cassava			Castor		
Groundnut	...	...	587	...	-	...	-	...	-
Cassava... ..	...	...	-	...	14,820	...	-	...	-
Castor	...	...	-	...	-	...	316	...	-
Groundnuts and Cassava	...	...	525	...	2,280	...	-	...	-
Groundnuts and Castor	...	...	524	...	-	...	58	...	-

Although the yield of intercropped groundnuts was not significantly lower than that in pure stands, cassava and castor yields were drastically reduced by intercropping.

In an experiment (MWA. 1C) carried out in 1958 on intercropping maize and sweet potatoes, planted at the same time, it was found that the mean yield of maize was unaffected by sweet potatoes, but that the yield of sweet potatoes was very greatly reduced from 4,795 lb. per acre in pure stand to 974 lb. intercropped.

The combination of maize and cotton planted in alternate rows also appears to be unfavourable.

TABLE 17
THE EFFECT OF INTERCROPPING COTTON AND MAIZE ON YIELDS, KARANGAI, ARUSHA

				Yield from 1 acre of intercrop			Yield from two half- acres in pure stands			
				Maize		Cotton	Maize		Cotton	
Maize planted in March and Cotton										
in April	...	...	...	660	...	200	...	490	...	545
Both planted in March	...	...	...	455	...	140	...	490	...	450

There was a reduction in the yield of cotton at both times of planting when intercropped with maize and this was not compensated by any appreciable increase in the yield of maize.

These results stand in great contrast to those obtained when maize and groundnuts are intercropped, the intercrop usually giving the greater return per acre. Further work is required to differentiate between combinations of crops that are suitable for intercropping and those that are not.

WEED CONTROL

On rice at Mlali, M C P A at 1 and 1.5 lb. per acre gave poor weed control, 2.4.D however at 1½ and 2 pints per acre gave very good control equivalent to hand weeding three times.

CONTROL OF TERMITE DAMAGE TO CROPS

Many annual crops in a number of areas in the Territory can be seriously damaged by termites even though they are growing well. Maize, pigeon-pea and soya-bean are particularly susceptible.

Preliminary trials using Aldrin as a seed-dressing and mixed in with the fertilizer were carried out at Nachingwea. High rates were used in order to obtain an assessment of the full potential of the crops used. Great variation in fertility of the land chosen unfortunately prevented the achievement of this aim. However it is known that high plant populations at harvest are required to produce high yields and so the effect of a treatment on harvest population is an excellent indication of its potential value for increasing yields.

A 40 per cent Aldrin seed-dressing was used at rates of 10, 20 and 30 oz. per 200 lb. seed and 40 per cent wettable powder at 5, 7½ and 12½ lb. per acre in fertilizer. The amount applied per acre varied with the seed rate of the crop and varied from 0.5 lb. for the low dressing on sesame to 1 lb. for the high dressing on maize.

TABLE 18
SHOWING THE EFFECT OF VARIOUS RATES OF ALDRIN APPLICATION ON PLANT
POPULATIONS AT HARVEST, 000s. PER ACRE

	Control	RESPONSES TO					
		Seed dressings, oz.			Application in fertilizer, Lb.		
		10	20	30	5	7½	12½
Maize ...	7.0	3.5	6.3	6.7	17.9	16.8	17.0
Sunflower ...	3.3	1.4	0.7	1.1	10.7	10.8	10.4
Soya ...	33.6	6.3	0.9	21.9	51.6	52.2	48.8
Sesame ...	26.0	3.7	4.8	0.9	7.1	9.1	7.9

The application of high rates of Aldrin in the fertilizer has led to an excellent increase in plant populations at harvest for maize, sunflower and soya. For sesame the increase was lower, but still appreciable. Seed dressings gave valuable increases for maize and for soya at the highest rate.

The mean increase in yield of maize for seed dressings was 340 lb. per acre and for application in the fertilizer it was 600 lb. per acre. The increase in yield of soya by application in the fertilizer was 400 lb. per acre but it was negligible for seed dressings except at the high rate, 260 lb. per acre. For sesame, seed dressings increased yield by 50 lb. and application in the fertilizer by 195 lb. per acre.

Yields of sunflower were very variable and reliable estimates of yield increase were not obtained. It was noticed, in the case of this crop, that Aldrin reduced the amount of seed removed by mice during germination.

A detailed examination of the data outlined above indicated that about 1 lb. of the active ingredient per acre would be about the lower limit for really effective control. This would cost Shs. 27/- per acre and the returns would be about Shs. 75/-, Shs. 140/- and Shs. 135/- for maize, soya and sesame respectively, based on this year's results.

INVESTIGATIONS OF LOCAL INTEREST

A number of date of planting experiments were carried out in the Wami-Magole area. Plant populations of the January planting of maize and sunflower were greatly reduced compared with the February planting. March plantings were low in all cases except for sunflower.

TABLE 19

YIELDS OF SEVERAL CROPS AT THREE DATES OF PLANTING AT WAMI,
LB. PER ACRE

	16th Jan.	17th Feb.	3rd March
Maize (Katumbili)	1,778	2,599	1,200
Sunflower (West Nile)	895	1,217	1,329
Sorghum (Msumbiji)	538	286	54
Groundnuts (N. Common)	1,782	929	636
Soya (Hernon 237)	1,522	1,437	627

Yields of soya bean and groundnuts were very good for the January planting. The soil is too heavy for groundnut production to be recommended, but soya bean would appear to be worth a trial on some of the farms. The production of 1,300 lb. of sunflower from a March planting is noteworthy.

Sesame also appears to be a crop on which more work should be done. The local variety which was harvested at the correct time yielded 385 lb. per acre. The variety Morada, a recent introduction, was harvested too late and yielded 422 lb. per acre. It was estimated that about 300 lb. per acre was lost by shattering.

The application of fertilizers to maize and sorghum did not give any worthwhile increases in yield.

In the Duthumi area of Eastern Province three dates of planting experiments maize and sesame gave their best yields at the February planting and groundnuts at the January planting.

TABLE 20

YIELDS OF SEVERAL CROPS AT THREE DATES OF PLANTING LB. PER ACRE

	Jan. 20th	Feb. 17th	March 28th
Maize (Katumbili)	1,334	2,016	1,152
Sesame (Morada)	691	946	243
Groundnuts (Natal Common)	1,378	698	429

The maximum yields of sesame and groundnuts are very satisfactory and that of maize reasonably satisfactory. Soya beans were tested, but emergence populations were very low and so results are unreliable. The best plot yields were equivalent to nearly 800 lb. per acre.

In Arusha District the application of boma manure increased maize yields generally by up to 460 lb. per acre. The application of two cwt. of sulphate of ammonia to onions at transplanting gave some extremely high increases in yield, from two to fifteen thousand pounds (average nine thousand) per acre. Soya beans grew well but were badly damaged by buck; in spite of this one variety yielded 620 lb. per acre so it would appear that this crop might do well.

A plot of pyrethrum on a rich volcanic soil in Mbulu District yielded 630 lb. of dried flowers per acre. Another on granitic soil gave 480 lb. per acre. Trials with peas suffered heavily from birds and game but one variety, "First and Best", yielded 700 lb. per acre.

Varietal trials on seven varieties of onions were carried out in Moshi District. None of the six imported strains proved outstanding the two South African varieties were of good yield and quality, but are thin-skinned and do not store well.

At Mtopwa sub-station, Newala District, the crops were sown rather late. The results suggest that normal levels of plant populations for various crops are required for maximum yields in pure stands, i.e. maize, 12,000; sesame 40,000; groundnuts 40,000. Fertilizers, superphosphate and sulphate of ammonia, generally gave a small but non-significant increase in yield, due probably to late planting and low April rainfall.

TABLE 21
EFFECT OF DATE OF PLANTING AND FERTILIZER APPLICATION ON
MAIZE. MTOPWA, LB. PER ACRE

Date of Planting	Unfertilized	Fertilized
23rd January	832	1,127
23rd February	54	173
10th March	36	94

Maize streak was common and wireworms, flea-beetles and eelworms attacked sesame. Vermin, crows, rats and jackals, damaged crops in the stook and dug seed out of the ground.

TRIAL MANAGEMENT FARMS

The results of experiments are usually obtained from crops that have received greater care than is normally given to them in systems of peasant agriculture.

Thus before the results of seemingly worthwhile methods can be economically assessed the methods must be tested under the practical conditions of farming with its limitations of labour input in time available for cultivations, planting, weeding, etc.

For this purpose a series of trial management farms is being organized. The farming system adopted is based on the local system but with a few improved practices incorporated such as could be adopted by the more progressive farmer. Detailed records are being kept of labour input, acreages covered in cultivations, etc., seed, fertilizer, manure, plant protection materials used and yields produced.

In this way improved practices can be tested and it can be seen if further experimental work is required to improve that already done or on problems that may arise when a new practice is adopted in a local farming system. Data will also be obtained on factors that cannot be studied readily, if at all, in formal statistical experiments.

Farms have been started at Tengeru, Kisarawe, Kilosa, Mwanhala and Urambo.

The results obtained should prove of great value in deciding upon the farming systems that should be adopted in the event of land enclosure.

CROPS

COTTON

Agronomy.

Extensive growth analyses were made at Ukiriguru on selections from Mwanza Local and Albar hybrids for the first time. A preliminary examination of the data has revealed strain differences in response to the severe drought conditions of the season. This work is required to assess the type or types of plant needed for Lake Province conditions from amongst the very complete range available.

Several variety trials were planted in the Northern and Tanga Provinces to determine the most suitable variety for these areas from amongst Ukiriguru, Uganda and Ilonga types. The results from the Tanga Province trial were unreliable, but excellent yields were obtained from the Moshi and Arusha trials with some irrigation, sprayed plots yielded 2,574 and 2,319 lb. seed cotton per acre respectively. All varieties yielded well but NC. 56 from Uganda produced the lowest yield.

A preliminary trial on an African farm adjacent to Ilonga, suggested that sulphate of ammonia might increase yield. Phosphate, sulphate of ammonia and farmyard manure were tested in factorial combination on an area that had been cropped for 10 years. Double superphosphate at a rate of 75 lb. per acre and farmyard manure at 5 tons per acre gave highly significant mean responses of 282 and 156 lb. of seed cotton per acre. Sulphate of ammonia gave a non-significant response of 90 lb. per acre.

Breeding and Selection.

The success of the programme carried out by the Empire Cotton Growing Corporation entomologist has revealed that bacterial blight is more important than has previously been thought in Eastern Province, its effects having been masked by severe insect damage. An extra Empire Cotton Growing Corporation officer has been posted to Ilonga to assist in a breeding programme to introduce resistance into the Ilonga strains.

All strains remaining from the selections made up to 1957 were compared in a large variety trial at Ilonga. The initial process of "sorting" out from a very variable stock is now almost complete and work can now be concentrated on a few main families. The progeny lines from three families were markedly superior to 47/10 and IL.58 in yield and ginning out-turn.

TABLE 22
MEAN PROGENY YIELDS FOR THREE FAMILIES COMPARED WITH
IL. 58 AND 47/10. LINT, LB. PER ACRE

Family	No. of progeny tested	Yield	G.O.T. %
48/64	8 ...	552 ...	33.4
51/77	5 ...	535 ...	31.1
51/111	10 ...	548 ...	31.6
IL. 58	Control ...	488 ...	30.1
47/10	Control ...	316 ...	29.4

The seven best selections of former years were tested at six sites in Eastern Province and one in Tanga Province under the following conditions:—

- (a) free from insect attack;
- (b) partial control of pests;
- (c) no control of pests.

In producing better yielding varieties for this area, where insect attack is likely to be heavy, intrinsic yielding ability is not the sole criterion for yield improvement in the field. The ability to recover from insect damage by rapid production of bolls is important.

The results of these trials have shown that several strains were superior to the controls (IL.58 and 47/10) under all conditions, but others were only superior when well protected against insect attack.

At Ukiriguru the three cotton breeding programmes, to which reference has been made in previous reports, were amalgamated. The immediate objective of the current programme is the production of commercial varieties, highly resistant to bacterial blight with other field characters up to the standard of the most recent seed issues and satisfying the quality requirements of the industry.

Many strains were again tested in "small bulks" experiments both on the Centre and on district plots, 31 experiments each comparing 25 strains being planted. In addition four experiments each comparing 49 progeny rows were planted. The results from district variety trials confirmed that the yield level in the more important families of Albar hybrids is comparable with that of the most recent Ukiriguru seed issues. Mean yields over all trials of the three seed issues now being grown commercially are shown below compared with Mwanza 561.

TABLE 23
MEAN YIELDS OF SEED ISSUES FROM NINETEEN VARIETY TRIALS

	Seed Cotton Lb. acre	G.O.T.	Lint Lb. acre	% of Mz. 561
Mz. 561	823 ...	32.9 ...	271 ...	100
Uk. 51	872 ...	33.6 ...	295 ...	108
Uk. 55	906 ...	34.7 ...	314 ...	116
Uk. 58	935 ...	35.0 ...	327 ...	121

Plant Protection.

Seed treatment experiments at Ukiriguru have established that many mercurial formulations are more efficient than copper formulations when compared on a cost basis for controlling bacterial blight. There is a clear indication that formulations containing the more toxic material, ethyl mercury chloride, were the more efficient. A new seed-dressing machine is under test and it is hoped that this machine, with some modifications, may be suitable for use with most types of dry mercurial dusts. The toxicity hazards to the operators is a most important factor being studied in the series of tests.

The work on trash-borne blight infection was continued. The organism could be detected in a pathogenic state in trash, left after harvest to decay in the fields, up to the third week in December but it could not be detected on January 7th. In another experiment trash exposed to the weather on 26th March was still infective during May but was completely sterile by June 9th. Thus it would appear that survival in a pathogenic state into the planting season is dependent on the amount and distribution rainfall during the dry season and early rains.

It was confirmed that trash-borne infection may be of negligible importance where ridge cultivation is practised. Where cultivation is on the flat, trash infection may be important when replanting rains are light or where planting is early.

An attempt was made to assess the yield increases to be expected from a highly resistant Albar hybrid under varying intensities of bacterial blight attack. Table 24 illustrates the main effects found.

TABLE 24
RESPONSES OF STRAINS UNDER DIFFERENT LEVELS OF ATTACK BY BACTERIAL
BLIGHT DURING THE SEASON

				Very light throughout		Light early but moderate to severe later		Moderate to severe throughout	
				% Grade C	Value Shs./acre	% Grade C	Value Shs./acre	% Grade C	Value Shs./acre
Local	...	...	...	6.7	566	12.5	492	22.5	296
Uk. 51	...	...	...	7.9	550	9.2	576	19.1	288
Uk. 55	...	...	...	6.0	538	6.5	571	12.3	336
Albar Hybrid	...	...	...	7.3	594	4.2	669	7.8	429

When the attack was light the percentage of Grade C cotton and value per acre were very similar for all four strains. With increasing severity of attack the percentage Grade C cotton remained low in the Albar hybrid but the value was appreciably greater, about Shs. 80/- per acre, over the next best strain.

The incidence of bacterial blight has become more noticeable during the last three years in Eastern Province. Earlier planting is more favourable than later planting for the spread of the disease and continuous cotton cultivation without trash disposal will increase its incidence. The problem of control is being studied along two lines at Ilonga, by seed dressing and breeding for resistance.

In a seed dressing experiment, a range of fungicides was tested against ordinary seed and acid delinted seed. Ordinary seed gave a yield of 1,147 lb. of seed-cotton per acre and acid treated, 1,442 lb. Dressed seed gave increases of the order of 183 lb. per acre and much lower percentages of infected plants in the early stages of growth.

Fusarium wilt was first recorded in Geita District in 1954. In 1957 and 1958 surveys were organized to determine the approximate extent of the area affected. On the information gained, it was decided to carry out an intensive survey of the district in 1959 as a basis for determining rate of spread in future years and the factors determining this.

It was formerly thought that the disease was restricted to the sandy soil bordering the lake shore. This year's survey has shown that the disease is present further inland than was formerly thought and that although most evident on the very sandy soil close to the Lake it is not confined to this soil type. It was found on light loamy soil on Kome Island about one mile from the Lake, at Lushamba on a heavy loam and at Kahunda 2-3 miles from the Lake. It was also found on a reddish hillsand near Karumo at the mouth of Mwanza Gulf.

Trials with a number of different strains of cotton suggest that some may have a degree of resistance to the disease and this line of work, and others, will be pursued in collaboration with the Cotton Research Station, Namulonge.

Counts were made of the numbers of insect pests and flared squares in the intercropping experiment reported on page 11. It is commonly thought that cotton intercropped with maize suffers more heavily from insect attack than cotton grown in pure stands. The results however, on sprayed and unsprayed cotton, presented below do not lend support to this thought.

TABLE 25
TOTAL NUMBER OF INSECTS AND FLARED SQUARES COUNTED ON 17 OCCASIONS
FROM MAY TO AUGUST AT TWO LOCATIONS ON 20 COTTON PLANTS IN PURE
STAND AND INTERCROPPED WITH MAIZE

			Karangai				Uri Chini			
			Control		Sprayed		Control		Sprayed	
Bollworms:										
Pure Stand	...	...	23	...	20	...	55	...	40	
Intercrop	...	...	13	...	6	...	12	...	9	
Stainers:										
Pure Stand	...	...	172	...	178	...	66	...	54	
Intercrop	...	...	130	...	72	...	12	...	9	
Flared squares:										
Pure Stand	...	...	133	...	156	...	532	...	363	
Intercrop	...	...	128	...	98	...	170	...	137	

The count for bollworms represents the total for American, spiny and pink bollworms. In all cases the number of insects and flared squares is less on the intercrop cotton, markedly so in 10 out of the 12 comparisons. Spraying 8 times at a rate of 1 lb. of D.D.T. per acre did not give efficient control.

At Ilonga, a few small American bollworms were found on pigeon-pea and fiwi bean (*Dolichos lablab*) in late September. No more were found until the end of December after the first rain following a dry season in which very little rain fell from early May onward. These bollworms were found on regenerated groundnuts. In January, large numbers were found on flowering *Mullugo nudicaulis*, *Tridax procumbens* and groundnuts. This sudden build-up lends support to the hypothesis that diapausing pupae are important in the carry-over of the pest from one season to the next. When flowering declined in *Tridax*, egg-laying occurred on groundnuts during late February and March. Maize was the next host in the succession but the infestation was much lower than usual. The later infestation on cotton built up very slowly and did not reach the high levels experienced in previous years. Late season hosts were again pigeon-pea and fiwi bean.

Spiny bollworm was responsible for the main loss of crop but was kept in check by spraying. It was not controlled so efficiently by D.D.T. as was American bollworm. Stainers caused negligible loss of crop and Jassid damage was remarkably low, only the most susceptible strains being affected. Red spider mite increased late in the season but was of no importance.

In an insecticide experiment to determine the efficiency of lower rates of application than the standard 1 lb. of D.D.T. per acre for 8 successive weeks it was found that the increase in yield using $\frac{1}{2}$ lb. was low but that from $\frac{3}{4}$ lb. was worthwhile. The addition of 1 oz. of Rogor per acre to the spray gave a worthwhile further increase. The reason for this was not determined.

In Sukumaland and at Biharamulo very little damage was done by bollworms and stainers. At Manonga (Nzega) there was a fairly heavy bollworm attack in March and April and stainers were fairly numerous. The crop suffered heavily in the new cotton growing areas of Bukoba, from American bollworm in March and April, high stainer populations in June and July followed by spiny and pink bollworms in August.

HIBISCUS

Agronomy.

A series of large trial plots was planted in the Northern Province using the varieties Cuban Laos and a mixture of ECR 985/986. Cuban proved to be a quick growing variety but its yield was low and the plant unpleasant to handle because of its urticating hairs. Laos grew far too slowly for the short length of the rains in 1959 and no harvesting was done. The ECR mixture grew fairly well and there were some outstandingly good plants. Seed was collected from these.

The most successful sowing was achieved using a wheat drill but there was a considerable amount of uneven growth due to the variable spacing of the plants in the rows. Seven men using pangas could cut an acre in a day, but only three were required when using secateurs. A further 3-4 men were required for collecting and stacking.

Retting the dried ribbons in the Magara swamps was not successful, the ribbons becoming tangled after being placed on a platform of poles and sunk by weighing down with heavy stones. Retting of whole stems was more successful but would be impractical under large scale production conditions owing to the high cost of transport of bulky material.

Yields per acre of fibre were disappointingly low, from 160-640 lb. per acre.

BEANS (*Phaseolus* spp.)

Agronomy.

Michigan pea bean produced a yield of 1,285 lb. per acre at Tengeru and so might be a useful crop for the area.

At Mbozi, local beans outyielded haricot beans and the variety Black Prince, the former producing 1,000 lb. per acre, the two latter only 200 lb. Yields on the ridge were considerably higher than on the flat 1,000 lb. as against 230 lb. for Local. Cow-peas and peas, vars, First and Best and Idaho White gave yields varying from 200-560 lb. per acre on the ridge but only 35-85 lb. on the flat at the early date of planting.

Plant Protection.

Seed treatment of seed beans as a protection against the attack of Bean fly can be effective. The degree of control varied widely in the experiments and this may have been due to the varied retention of the insecticide on the seed coat. When aldrin powder was slurried with water there was better retention than when it was used as a powder and the damage rate only rose above 15 per cent in one out of three trials. Rogor 40 appeared promising as a control but is not available in powder form suitable for seed dressing.

CASHEW

Agronomy.

The Zanzibar and Portuguese East Africa varieties were originally planted at 20 by 20 ft. at Chambezi in 1953 and had become overcrowded. Part of each plantation was thinned to halve the tree population early in the year.

Zanzibar yielded rather higher than Portuguese both thinned and unthinned, 1,115 lb. as against 850 lb. of nuts per acre. It is likely that thinning had no effect on yield per acre as the yield per acre at the wider spacing was higher for Zanzibar but lower for Portuguese. The yield per tree increased considerably with thinning from 6.4 to 16.1 lb. for Portuguese and 12.3 to 19.6 lb. for Zanzibar. Collection of fallen nuts was much easier in the thinned areas.

Plant Protection.

Damage by *Helopeltis* sp. in the Southern Province as a whole was not serious, perhaps due to the long dry periods that occurred during the rainy season being unfavourable to the build up of a large population. In two areas at Nachingwea the trees were badly attacked and work on chemical control was possible for the first time on older trees.

A severe attack of *Helopeltis* sp. occurred on a three-year old plantation. The trees were sprayed seven times with 4 fluid oz. of Dieldrin in 4 gal. of water per acre. Sprayed trees bore twice as many flowers as the unsprayed and were three weeks earlier in coming into flower. There was an appreciable increase in yield, from 515 lb. to 790 lb. per acre, from spraying. The response of 275 lb. is clearly not economic. Cashew prices fluctuate considerably and the increase could be worth from Shs. 60/- to Shs. 100/-. The insecticide alone costs Shs. 70/-. It may be possible to reduce the number of applications since similar pests on cocoa in West Africa can be controlled economically by 2 or 3 applications.

On two-year old trees the maximum yield from sprayed plots was 46 lb. per acre. Trees planted in 1954 on a Tanganyika Agricultural Corporation production farm yielded 637 lb. in 1958 and 799 lb. per acre in 1959. When compared with the yield from unsprayed three-year old trees (515 lb.) these yields seem very low and it would appear that the full potential of older trees has not yet been ascertained.

CASSAVA

Agronomy.

In 1958 and 1959 the variety Kibangiri out-yielded all other varieties at Chambezi. A strong local preference is shown for the Amani variety 46106/27. Both varieties show medium resistance to mosaic disease and are being bulked up for further study and distribution if required.

MAIZE

Plant Breeding and Selection.

The main emphasis throughout this work has again been placed on the production of suitable short-season varieties. Breeding work continued at Tengeru and progeny testing was done on a number of crosses.

In a variety trial at Mwanhala a number of "short-season" varieties gave yields of the same order as Katumbili but with a maturity period of 112-120 days as against 133 days. In observation plots three varieties matured in 92-98 days as against 130 days for Katumbili. Their yields were much lower. It is likely that better yields will be obtained at a closer spacing than was used. "Hopi" maize from the arid lands of South-Western U.S.A. was tested. The seed was of low viability but some plants showed promise, carrying a fair sized cob on a small plant. At Ukiriguru, two "short-season" varieties were compared with local Katumbili, both yielded at the same level, 1,200 lb. per acre, but only one had an appreciably shorter growth period, 108 as against 120 days.

PYRETHRUM

Agronomy.

With the appointment of an officer to carry out full-time research on pyrethrum a new programme has been drawn up and is being implemented. In both Northern and Southern areas special emphasis is being placed on producing improved material for planting. Seed of a number of new varieties for testing in the Northern area has been provided by the Department of Agriculture, Kenya. In the Northern area experiments to study spacing suitability of splits from 2-, 3- and 4-year old plants for planting compared with seedlings and the effect of time of planting during the day have been planted.

In a rotation experiment planted to pyrethrum after two previous seasons of varied cropping, green manuring and fallowing, no previous treatment or group of treatments showed any striking improvement in yield over the others. Fallow and green manure for two successive years or in alternation did not show any sign of improving yields. Wheat and pea yields in previous years were not high.

In the experiment testing the value of "Dutch Mixture" (30 per cent P_2O_5 and 6.5 per cent N) applied at 200 lb. per acre the final results have shown that this application has given responses of 275 and 233 lb. of dried flowers per acre over three years on red and black soils respectively. These responses are greater than those given by superphosphate and basic slag treatments at equivalent rates.

Two experiments studying three rates of application of superphosphate, potash and nitrogen, on red and black soils were planted. The results of the first season's picking do not show any responses to the applications which were made on an overall application of 100 lb. of superphosphate.

In the cutting-back experiments, cutting back in mid March, April and May in addition to one in December again reduced yields appreciably.

Plant Protection.

In two trials carried out to estimate damage due to thrips it was found that frequent spraying, 15 times during the year, with dieldrin and D.D.T. had no effect on yield. Thrips were observed on the leaves in fair numbers from time to time and were killed by spraying.

TABLE 26
EFFECT OF FREQUENT SPRAYING AGAINST THIRPS—LB. OF
DRIED FLOWERS PER ACRE

					4-year old stand		3-year old stand
Control	...	...	...	...	201	...	369
Dieldrin	...	...	...	...	219	...	349
D.D.T.	...	...	...	...	205	...	373

RICE

Agronomy.

In a spacing trial at Mlali, Morogoro District, the highest yield, 6,160 lb. per acre, was given at a 6 in. by 6 in. spacing; 12 in. by 12 in. and 18 in. by 18 in. yielded 5,120 and 4,680 lb. of undried paddy respectively. The soils here are very variable and some soils appear to have improved with working; puddling, however, did not show any significant increase in yield over non-puddling.

Testing of strains is continuing at Mahiwa, Lindi District. Obviously poor strains have been eliminated during the past three years and the better ones will be tested for a further two years. Palatability tests are being done.

SORGHUM

Plant Protection.

The second test crop of sorghum on a long term experiment at Ukiriguru to test the value of several rotations and intensities of hand pulling on the control of Striga was planted. A summary of the results is presented in Table 27.

TABLE 27
EFFECT OF ROTATIONAL CROPPING AND HAND PULLING FOR CONTROL
OF STRIGA. YIELDS OF SORGHUM LB. PER ACRE, STRIGA PLANTS,
THOUSANDS PER ACRE

					Yield	Striga
Mean of 8 rotations	...	...	...	...	277	224
Five year's continuous cotton	...	...	...	...	326	252
Continuous sorghum, striga not pulled	...	...	...	...	311	254
Continuous sorghum striga pulled every 42 days	...	...	...	...	339	261
Continuous sorghum striga pulled every 28 days	...	...	...	...	463	244
Continuous sorghum, striga pulled every 14 days	...	...	...	...	690	204

Clearly the rotational cropping, which included one or two years of sorghum in the three-year cycle, and continuous cotton for five years gave no control. Pulling every 42 days had no effect, but useful increases in yield were obtained by pulling every 14 or 28 days.

In the Old Striga Trial, pulling striga again gave useful increases in yield for both Bukura Mahemba and the resistant Dobbs varieties, the yield of the former increasing from 438 lb. to 808 lb. and of the latter from 683 to 1,602 lb. per acre.

TOBACCO (Flue-cured)

Agronomy.

A number of experiments were planted to study the fertilizer (N.P.K.) requirements of tobacco at Urambo. In one experiment (URB.3) the control yield was low, 368 lb. cured leaf per acre, but the application of fertilizers gave greatly increased yields. Phosphate gave no significant increase in yield but the lower rates of application of nitrogen and potash, 0.3 cwt. N and 0.75 cwt. K_2O per acre, gave a response of 554 lb. per acre. The higher rates of application of these fertilizers did not increase responses appreciably.

Three rates of sulphate of ammonia, muriate of potash and superphosphate in all combinations were tested on red and grey soils, the lowest rate of each being nil. On the red soil the mean yield was 574 lb. cured leaf per acre, but fertilizers gave no increases in yield. On the grey soil only phosphate gave a significant increase in yield of 115 lb. per acre on a low yield of 318 lb. without phosphate.

At a rate of 22 lb. N per acre, sulphate of ammonia and urea and a mixture of equal parts of both were equally effective. At a higher rate, 44 lb. N, urea alone gave an appreciably reduced yield compared with the other two treatments.

On both red and grey soils plantings in December gave the highest yields. Late January and early February plantings were very low, 51-193 lb. per acre. In a topping experiment the three topping treatments (normal, high and low) gave higher yields than no topping but differences were not significant.

WHEAT

Plant Breeding and Selection.

The rapid infection of new varieties under test by stem and leaf rust continues. Out of 519 varieties from the International Wheat Rust Nursery only 15 were worth harvesting and only two were free of rust. Both of these were late varieties.

Other varieties considered suitable for further testing or for initial multiplication were planted. All of these were infected only one being recorded as relatively free from rust.

Since other countries with large resources for plant-breeding and plant-pathology are not making any headway with this problem the chances of a successful outcome are of the slightest.

Seven varieties were planted in observation plots at Muscat, Morogoro District, the local variety produced 700 lb. per acre but three of the other introduced varieties gave good yields 1,542, 1,696 and 1,728 lb. per acre.

PASTURE

Agronomy.

A start has been made on a comprehensive programme of research at Ukiriguru particularly in regard to the mbuga and itogoro soil types. An excellent sward of Rhodes grass has been established on one field of "itogoro". Paddocks have been fenced for a rotational grazing experiment and a standing hay experiment. Observation plots on a number of species of grasses, legumes and hedging plants have been planted.

At Nachingwea, 9 acres of Rhodes grass established to produce farmyard manure for one of the Farming Systems experiments maintained six cows and two calves and produced in addition six tons of hay.

With the re-organization of the experimental farm at Ilonga a number of paddocks have been re-sited and so the grazing management experiment on *Panicum maximum* has been postponed for one year. Studies on the control of *Acacia campylacantha* by ring barking and spraying are continuing.

Preliminary investigations indicate that Rongai Rhodes grass produces heavier yields on volcanic soil at Tengeru than Mpwapwa Rhodes grass. Elephant grass is still the most prolific yielder of fodder grass but *Setaria splendida* and *Panicum maximum* also continue to produce good yields in the third year of establishment. A number of new grasses and

legumes have been established in observation plots. *Dolichos* sp. has disappeared almost entirely within two years of establishment, but lucerne and *Glycine javanica* have maintained themselves in the Rhodes grass—legume grazing trial.

At the Northern Province Stock Farm there is no noticeable difference yet in the botanical composition or basal cover of plots undergoing various treatments, early and late burning, cutting, and grazing only with no burning. At Oljoro, Rhodes and *Panicum coloratum* have done very well and a local *Cynodon plectostachyus* produced prolific growth and appears promising.

COFFEE

Agronomy.

Robusta

At Maruku, a second clone experiment has been planted, also a new seedling establishment trial to see if swamp soil could be used as a substitute for cattle manure which is in short supply. A comprehensive programme has started to study methods by which old neglected coffee might be improved. This includes pruning, fertilizing and mulching.

It has been found that after three years growth the lateral feeding roots have spread to an average distance of 8 feet from the tree but to a depth of only one foot outside the planting hole.

In the Coffee and Banana Interplanting Experiment (MAR. 10) the bananas have reduced the growth of both robusta and arabica coffee in proportion to the density of the bananas.

TABLE 28
EFFECT OF INTERPLANTING COFFEE WITH BANANAS, HEIGHT OF TWO-YEAR-
OLD TREES IN INCHES

		BANANA STOOLS PER ACRE							
		0		100		200		400	
Arabica	...	...	73	...	65	...	62	...	50
Robusta	...	...	45	...	41	...	35	...	30

Arabica

Experiments to compare a range of varieties were planted in five areas of West Lake Province. Exceptionally good growth has been made at Maruku and Kawalinda. At Maruku the coffee came into bearing at 18 months and gave an average of 100 lb. clean coffee in the period May 1959–January 1960. The three drought resistant types, SL. 14, 28, 34, have, so far, produced the tallest trees generally and the varieties K7, KP 162, KP 432 and H66, were unaffected by *Hemileia* leaf rust at Kituntu and Maruku whilst all other varieties were attacked.

At the Mbozi coffee research station, the experiments continued to yield at a miserably low level, about 1 cwt. clean coffee per acre, except when irrigated. In an attempt to mitigate the effects of the harsh dry season, windbreaks and local shelter belts are being planted and mulching extended. Stripping the crop in the early years of growth is being done in some cases in an effort to encourage a vigorous root-stem system. In the fertilizer experiment (MBO.4) the adverse effect of phosphate is now obvious and application has been stopped. In order to reduce susceptibility to wash and improve growing conditions generally the experiment is being mulched. Since the amount of potash and calcium applied in the mulch is large compared with the rates of application these treatments are being discontinued and the potash plots are being used to test two higher levels of sulphate of ammonia. Vigour scores indicate a response to this fertilizer.

On the Irrigation Plot I (planted 1956) the irrigated coffee developed well and yielded, 4.4 cwt. per acre of clean coffee, the unirrigated yielded 1.6 cwt. There was no dieback on the irrigated trees, but it was present on the unirrigated trees.

The variety trial on Ng'amba Estate, which is irrigated, had an average yield of 8.6 cwt. of clean coffee per acre which is remarkably high for Mbozi. The variety P280/21 produced the highest yield, 10.9 cwt. per acre, it also has the highest 5-year average. This selection originally came from Mbozi. No significant differences were found between the yields of half-plots treated with a zinc-boron spray and the untreated.

Observational trials were carried out by the owners of two estates, Ng'amba and Mlowo, to test the value of frequent copper spraying on leaf retention. At Ng'amba there was but little difference between sprayed and unsprayed from January to April. Thereafter trees that were sprayed retained the same number of leaves as before until August whereas unsprayed trees suffered fairly heavy leaf-fall. The sprayed trees shed leaves during the period September to November but their remaining leaves are much greener than those remaining on the unsprayed trees.

At the new Mitalula sub-station, Rungwe District, the following experiments have been planted:—Mulching and Varieties (MIT.1) and Fertilizer (MIT.2) together with a Shade Observation trial comparing various densities and patterns of banana shade.

TEA

Agronomy.

Plucking was carried out on some old abandoned tea bushes at Maruku which had been stumped back in 1956 and pruned into shape. They produced a yield averaging three-quarters of a pound of green leaf per bush during the year. In the Tea Establishment experiment (MAR.16), 15 lb. of farmyard manure per planting hole produced considerable growth responses. In this and another experiment (MAR.18), urea had a most adverse effect and many young bushes died. The biuret content of the urea was only 0.3 per cent. Sulphate of ammonia gave a marked improvement in growth and leaf colour.

COCOA

Agronomy.

Observation plots have been planted in a number of areas where there would appear to be fair prospects for cocoa production. A wide range of types is being tested under different intensities of shade.

A soil survey was carried out on an area being considered for cocoa planting in Tanga Province. The rocks underlying the area are rather poor in basic minerals. The soils are very mature and weathered to a great depth and compaction zones frequent. As a first estimate, 15 per cent of the area is assessed as good to fair and 10 per cent as fair to moderate for cocoa production.

COCONUTS

Agronomy.

An experiment planted in 1953 at Chambezi to study the effect of planting hole size and the value of farmyard manure, kiln ash and coconut husk at planting time has shown no effect by any of the treatments. This experiment has been replanned to study the effects of clean cultivation beneath the palms against no cultivation, other than preventing bush regeneration, and annual cropping between the rows of palms. The value of husk and leaf ash and farmyard manure is also being tested.

No benefits have yet been shown from the continued application of fertilizers to palms planted in 1954. Rates of application have been considerably increased as some of the palms are beginning to bear.

Fertilizers applied to individual adult palms also have shown no increase in yield. An analysis of past records of yields of a large number of palms suggests that there is a very strong tendency for cyclic production to occur. As an indication of the magnitude of this the following figures for groups of high and low yielding palms are given below.

TABLE 29
SHOWING CYCLIC PRODUCTION OF NUTS FOR HIGH AND LOW YIELDING
PALMS, NUTS PER PALM

	1954		1955		1956		1957		1958
High yielding ...	62	...	156	...	102	...	82	...	57
Low yielding ...	53	...	85	...	32	...	23	...	25

With changes of the above order from year to year any effect from fertilizers would have to be very large indeed for it to be measurable on an individual palm basis.

An investigation into the flowering habits of the coconut palm has been started to see if the reason for this cyclic production is due to suppression of the number of spathes produced in a year, or to reduction in the number of female flowers produced or to increased immature nut-fall.

GROUNDNUTS

Agronomy.

In the Lake Province experimental work on groundnuts was extended in view of the good results obtained in 1958. At Ukiriguru the variety Natal Common out-yielded the local Matebele by 310 lb. per acre, the latter variety producing 544 lb. per acre. The importance of achieving high plant populations to produce maximum yield was shown, a population of approximately 45,000 giving high yields. Seed treatment with Fenasandi to control seed rots increased the plant population by 6,000 and the yield by 168 lb. per acre. The application of phosphate, 1 cwt. of double superphosphate per acre, did not give any increase in yield on the hill-sand soil. The yield without fertilizer was a good one, 1,315 lb. per acre.

At Nyamahona, a low plant population of 14,000 per acre gave a yield of 403 lb. whilst a high population of 60,000 yielded 842 lb. per acre. Good yields were obtained with a high plant population planted early in January, 1,305 lb. per acre.

The results show, in areas where rosette disease is not prevalent, that Natal Common, planted early at a high seed rate (approximately 50 lb. per acre) and treated with Fenasandi, is a very suitable variety and capable of producing high yields.

SESAME

Agronomy.

A wide range of varieties was planted at Ukiriguru and several varieties at other places. Insect attack was severe and yields low. Sesame does not appear to be a suitable crop for large areas of the Lake Province.

Plant Breeding and Selection.

In two experiments comparing the variety Morada with unselected local sesame and selections from local sesame, this variety out-yielded all selections and gave a yield three times greater than that of the unselected. Only one strain of local gave a yield approaching that of Morada.

From material obtained by crossing Local sesame with varieties from Venezuela to obtain plants combining the valuable yield characteristics of the introduced varieties with the drought resistance of Local, about 1,200 plants were selected from the Morada $\times$ Local cross for planting in plant-to-row lines next season. Smaller numbers have been selected from other less promising crosses and these will have to be grown on in bulk plots for further selection as sufficient resources are not available for following the pedigree method of breeding for these.

From crosses of Local and Venezuela varieties with two indehiscent varieties from U.S.A. it would not appear that suitable varieties would be obtained by continued selection. A programme of back-crossing and multiple crossing has been started to try to eliminate the undesirable characters associated with the indehiscent character.

SOYA BEANS

Agronomy.

A range of varieties was grown at Ilonga. The short season varieties outyielded the long season varieties some giving good yields varying from 1,000-1,531 lb. per acre. Innoculation did not improve yields in a date of planting experiment.

At Tengeru a few varieties produced yields of the order at 700-800 lb. per acre, others grew vigorously but failed to set seed.

A number of varieties of Rhodesian dwarf soya were tested at Mbozi. Yields varied from 344-1,040 lb. per acre whereas Hernon 237 only yielded 35-105 lb. These dwarf varieties may be suitable for higher areas where Hernon 237 produces large quantities of leaf but only a little grain.

In a number of experiments in Lake Province yields were rather low 400-600 lb. per acre, at Nyamahona only were promising yields obtained, 700-950 lb. per acre.

Plant Breeding and Selection.

The breeding and selection programme is proceeding very satisfactorily. Hernon Nachingwea has maintained its superiority in yield over Hernon 237 and will be grown on a fairly large scale on the Tanganyika Agricultural Corporation's production farms.

Several thousand lines from a wide range of crosses have been grown and many of these were tested in 1959 in a series of Lattice strain trials. Many of the strains show an appreciable increase in yield over both parents and also other improvements. Results to date suggest that the breeding programme may result in an improvement of yield to the order of 50 per cent together with resistance to lodging, less susceptibility to shattering and a better plant habit more suitable to combining than Hernon 237. The proportionate yield might well be higher on production farms.

A number of the earlier promising strains have been bulked up on an irrigation scheme during the dry season and are being tested under farming conditions.

